

THE SCIENCE BEHIND CHOCOLATE MILK'S BENEFITS AS A RECOVERY DRINK

Lowfat chocolate milk *naturally* has many of the nutrients most commercial recovery drinks have to add in the lab – including high-quality protein and key electrolytes like calcium, potassium, sodium and magnesium.

To check out the science behind chocolate milk's benefits as a recovery drink, click here <http://www.refuelwithchocolatemilk.com/science/> or download and handout the following!

Liquid Assets of Chocolate Milk

Lowfat chocolate milk has 9 essential nutrients, including some not typically found in recovery drinks, that an athlete needs to perform at his or her best every time.

These include B vitamins for energy to get you going, and the combo of FIVE bone-building nutrients – calcium, vitamin D, phosphorus, protein and potassium –to help athletes build and maintain strong bones and reduce risk for stress fractures.

Refuel & Recover

Lowfat chocolate milk contains the right mix of carbs and protein to refuel muscles after a tough workout. It helps restore muscles quickly and to their peak potential to help you perform your best during your next bout of exercise.

- Replacing muscle fuel (glycogen) after exercise is essential to an athlete's recovery. A recent study found that drinking 16 ounces of fat-free chocolate milk with its mix of carbohydrates and protein (compared to a carbohydrate-only sports drink with the same amount of calories) led to greater concentration of glycogen in muscles at 30 and 60 minutes post exercise.¹
- An Indiana University study found endurance-trained cyclists who drank lowfat chocolate milk after an intense period of cycling were able to work out longer and with more power during a second exercise period compared to when the same athletes drank a commercially available carbohydrate replacement drink, and just as long as when they consumed a traditional fluid replacement drink.²
- In another study, after an initial exercise and recovery, cyclists were able to cycle 51% longer during a second bout of exercise after drinking chocolate milk than after drinking a carbohydrate replacement drink with the same number of calories.³
- In a study of 13 male college soccer players, post-exercise consumption of lowfat chocolate milk was found to provide equal or possibly superior muscle recovery compared to a high-carbohydrate recovery beverage with the same amount of calories following a four-day period of intensified soccer training.⁴
- Researchers at the University of Texas at Austin found that following an exhausting ride, trained cyclists had significantly more power and rode faster, shaving about six minutes,

on average, from their ride time when they recovered with lowfat chocolate milk compared to a carbohydrate sports drink and calorie-free beverage.⁵

- In a recent study, 32 healthy but untrained cyclists who recovered with lowfat chocolate milk had twice the improvement in VO₂max – a measure of aerobic fitness and adaptation – after a 4.5 week cycling regimen – compared to athletes who grabbed a carbohydrate drink.⁶

1. Karfonta KE, Lunn WR, Colletto MR, Anderson JM, Rodriguez NR. Chocolate milk enhances glycogen replenishment after endurance exercise in moderately trained males. *Medicine & Science in Sports & Exercise*. 2010;42:S64.

2. Karp JR, Johnston JD, Tecklenburg S, Mickleborough TD, Fly AD, Stager JM. Chocolate milk as a post-exercise recovery aid. *International Journal of Sport Nutrition and Exercise Metabolism*. 2006;16:78-91.

3. Thomas K, et al. Improved endurance capacity following chocolate milk consumption compared with 2 commercially available sport drinks. *Applied Physiology, Nutrition and Metabolism*. 2009;34:78-82.

4. Gilson SF, et al. Effects of chocolate milk consumption on markers of muscle recovery during intensified soccer training. *Medicine & Science in Sports & Exercise*. 2009; 41:S577.

5. Ferguson-Stegall L, McCleave EL, Ding Z, Doerner PG, Wang B, Liao YH, Kammer L, Liu Y, Hwang J, Dessard BM, Ivy JL. Postexercise carbohydrate-protein supplementation improves subsequent exercise performance and intracellular signaling for protein synthesis. *Journal of Strength and Conditioning Research*. 2011;25:1210-1224.

6. Ferguson-Stegall L, McCleave EL, Ding Z, Doerner PG, Liu Y, Wang B, Dessard B, Kleinart M, Healy M, Lassiter G, Ivy JL. Aerobic exercise training adaptations are increased by post-exercise carbohydrate-protein supplementation [Abstract]. In: American College of Sports Medicine 58th Annual Meeting; 2011 May 31-Jun 4; Denver, CO. Poster nr D-29.

Repair & Rebuild Muscles

Lowfat chocolate milk contains high-quality protein to help repair and rebuild muscles after strenuous exercise. It's also been shown to help athletes tone up – gain more lean muscle and lose fat – compared to drinking a carb-only drink.

- Recent studies have found that subjects who drank regular or flavored milk after a strenuous muscle workout experienced less exercise-induced muscle damage than those who drank water or typical sports drinks.^{7, 8}
- In a recent study, post-exercise muscle biopsies in eight moderately trained male runners showed that after drinking 16 ounces of fat free chocolate milk, the runners had enhanced skeletal muscle protein synthesis – a sign that muscles were better able to repair and rebuild – compared to when they drank a carbohydrate-only sports beverage with the same amount of calories. The researchers suggest that “athletes can consider fat free chocolate milk as an economic nutritional alternative to other sports nutrition beverages to support post-endurance exercise skeletal muscle repair.”⁹
- In a study of healthy, untrained men, those who consumed fat-free milk after exercise gained more muscle and lost more body fat at the end of a 12-week training program than those who drank a soy protein beverage or a beverage containing only carbohydrates. All three beverages had the same amount of calories. A second study found similar results for women.^{10, 11}

- In a recent study, 32 healthy but untrained cyclists who recovered with lowfat chocolate milk gained more muscle and lost more fat during training, with a 3 pound lean muscle advantage, compared to athletes who grabbed a carbohydrate drink.¹²

7. Cockburn E, Hayes PR, French DN, Stevenson E, St Clair Gibson A. Acute milk-based protein-CHO supplementation attenuates exercise-induced muscle damage. *Applied Physiology, Nutrition & Metabolism*. 2008;33:775-783.

8. Cockburn E, Stevenson E, Hayes PR, Robson-Ansley P, Howatson G. Effect of milk-based carbohydrate-protein supplement timing on the attenuation of exercise-induced muscular damage. *Applied Physiology, Nutrition and Metabolism*. 2010;35:270-277.

9. Lunn WR, Colletto MR, Karfonta KE, Anderson JM, Pasiakos SM, Ferrando AA, Wolfe RR, Rodriguez NR. Chocolate milk consumption following endurance exercise affects skeletal muscle protein fractional synthetic rate and intracellular signaling. *Medicine & Science in Sports & Exercise*. 2010;42:S48.

10. Hartman JW, et al. Consumption of fat-free fluid milk following resistance exercise promotes greater lean mass accretion than soy or carbohydrate consumption in young novice male weightlifters. *American Journal of Clinical Nutrition*. 2007;86:373-381.

11. Josse AR, Tang JE, Tarnopolsky MA, Phillips SM. Body composition and strength changes in women with milk and resistance exercise. *Medicine & Science in Sports & Exercise*. 2010;42:1122-1130.

12. McCleave EL, Ferguson-Stegall L, Ding Z, Doerner PG, Liu Y, Kammer L, Wang B, Wang W, Hwang J, Ivy JL. Effects of aerobic training and nutritional supplementation on body composition, immune cells and inflammatory markers [Abstract]. IN: American College of Sports Medicine 58th Annual Meeting; 2011 May 31-Jun 4; Denver, CO. Poster nr C-24.

Rehydration

It's vital to replace lost fluids after exercise, and lowfat chocolate milk is a nutrient-laden liquid that helps you rehydrate. In fact, researchers have found that milk may even be a better choice to help you *stay* hydrated than some commercial sports drinks.

- Research has shown that drinking lowfat or fat-free milk after exercise could restore hydration better than other popular post-exercise beverages. The study compared the rehydration effectiveness of four beverages: lowfat milk, lowfat milk with added sodium, water, and a sports drink. After an exercise session in a warm climate, participants were given one of the four test beverages, and researchers measured hydration status. They found that milk may be more effective than water or sports drinks at restoring and maintaining normal hydration status after exercise, likely due to milk's electrolyte content and energy density.¹²
- In a second study, the same researchers found that drinking fat-free milk after a period of exercise-induced dehydration restored fluid balance better than a commercial sports drink.¹³

12. Shirreffs SM, Watson P, Maughan RJ. Milk as an effective post-exercise rehydration drink. *British Journal of Nutrition*. 2007;98:173-180.

13. Watson P, et al. A comparison of the effects of milk and a carbohydrate electrolyte drink on the restoration of fluid balance and exercise capacity in a hot, humid environment. *European Journal of Applied Physiology*. 2008;104:633-642.

Electrolyte Replacement

Chocolate milk is a “natural” when it comes to electrolytes. In fact, chocolate milk naturally provides some of the same electrolytes that are added to commercial recovery drinks – including calcium, potassium, sodium and magnesium.

Drinking milk after exercise can help replace essential electrolytes—including potassium, sodium, magnesium, and calcium—that are lost in sweat. Research suggests rigorous exercise could cause substantial losses of calcium, which may increase the risk of stress fractures.^{14, 15, 16} And calcium and vitamin D are not typically found in other commercial recovery drinks.

14. Martin BR, et al. Exercise and calcium supplementation: effects on calcium homeostasis in sports women. *Medicine & Science in Sports & Exercise*. 2007; 39:1481-1486.

15. Sawka MN, Montain SJ. Fluid and electrolyte supplementation for exercise heat stress. *American Journal of Clinical Nutrition*. 2000;72:564S-572S.

16. Klesges RC, et al. Changes in bone mineral content in male athletes. Mechanisms of action and intervention effects. *Journal of the American Medical Association*. 1996; 276:226-230.

Refuel Research Methodology

Title: Effects Of Chocolate Milk Consumption On Leucine Kinetics During Recovery From Endurance Exercise

Karfonta KE, Lunn WR, Colletto MR, Anderson JM, Rodriguez NR. Chocolate milk enhances glycogen replenishment after endurance exercise in moderately trained males. *Medicine & Science in Sports & Exercise*. 2010;42:S64.

BRIEF topline of how the research was conducted:

The purpose of this study was to determine Whole-body protein turnover in moderately trained endurance runners following consumption of fat free chocolate milk (CMILK) after endurance exercise.

Moderately trained male runners participated in a two week long study during which they consumed a eucaloric diet that provided protein intake at 1.5 g·kg⁻¹. On days 7 and 14, blood and breath samples were obtained during recovery following a 45-min run at 65% of VO₂peak after which participants consumed 16 oz. of either CMILK or a non-nitrogenous, isocaloric control beverage (CON). Findings suggest chocolate milk consumption during recovery from a moderate intensity run attenuates whole body protein breakdown compared to a carbohydrate beverage. The long term benefits of chocolate milk to whole body, as well as skeletal muscle, protein utilization in endurance athletes warrants further investigation.

Link: <http://www.abstractsonline.com/Plan/ViewAbstract.aspx?sKey=071ac1bf-9800-4d71-ba8d-78f3aad379c0&cKey=f7598837-b693-4c5b-890a-560e196f3040&mKey=%7b24A58842-A6E4-47C5-889B-B8D603BBBA25%7d>

Title: Chocolate milk as a post-exercise recovery aid.

Karp JR, Johnston JD, Tecklenburg S, Mickleborough TD, Fly AD, Stager JM. Chocolate milk as a post-exercise recovery aid. International Journal of Sport Nutrition and Exercise Metabolism. 2006;16:78-91.

BRIEF topline of how the research was conducted:

On three separate days, nine male endurance cyclists performed an interval workout followed by 4 h of recovery followed by an endurance trial to exhaustion at 70% VO₂Max. After the first exercise and 2 h of recovery, subjects drank isovolumic amounts of chocolate milk, fluid replacement drink or carbohydrate replacement drink in a single-blind randomized design. Time to exhaustion, average heart rate, rating of perceived exertion, and total work for the endurance exercise were compared between trials. Time to exhaustion, and total work were significantly greater for chocolate milk. Findings suggest that chocolate milk is an effective recovery aid between two exhausting exercise bouts.

Link: <http://www.ncbi.nlm.nih.gov/pubmed/16676705>

Title: Improved endurance capacity following chocolate milk consumption compared with 2 commercially available sport drinks.

Thomas K, et al. Improved endurance capacity following chocolate milk consumption compared with 2 commercially available sport drinks. Applied Physiology, Nutrition and Metabolism. 2009;34:78-82.

BRIEF topline of how the research was conducted:

Nine trained male cyclists performed 3 experimental trials in a randomized counter-balanced order consisting of a glycogen depleting trial, a 4 hour recovery period, and each cycle to exhaustion at 70% power at maximal oxygen uptake. At 0 and 2 h into the recovery period participants consumed chocolate milk, a carbohydrate replacement drink or a fluid replacement drink. Participants cycled 51% and 43% longer after ingesting chocolate milk compared to the other drinks.

Findings concluded that chocolate milk is an effective recovery aid after prolonged endurance exercise for subsequent exercise at low-moderate intensities

Link: <http://www.ncbi.nlm.nih.gov/pubmed/19234590>

Title: Effects Of Chocolate Milk Consumption On Markers Of Muscle Recovery During Intensified Soccer Training: 2934: Board #81 May 30 9:30 AM - 11:00 AM

Gilson SF, et al. Effects of chocolate milk consumption on markers of muscle recovery during intensified soccer training. *Medicine & Science in Sports & Exercise*. 2009; 41:S577.

BRIEF topline of how the research was conducted:

13 male soccer players completed two intervention cycles consisting of one week of normal training followed by four days of intense training. After each day of intense training the players drank a high carbohydrate drink in one intervention and chocolate milk in the other. At day two and four researchers measured creatine kinase and myoglobin levels, muscle soreness, mental and physical fatigue, peak isometric force of the quadriceps, and leg-extension repetitions. Researchers found that serum creatinine kinase levels, a marker of muscle damage, were significantly lower after drinking chocolate milk than when the players drank the high-carb beverage.

Link: http://journals.lww.com/acsm-msse/Citation/2009/05001/Effects_Of_Chocolate_Milk_Consumption_On_Markers.3133.aspx

<http://www.medpagetoday.com/PrimaryCare/ExerciseFitness/14491>

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